CATHODE RAY TUBE AND METHOD OF DISPLAYING PICTURE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to a cathode ray tube, which displays a main picture in a single color and a method of displaying pictures.

2. Description of the Related Art

In recent years, a number of picture display devices capable of displaying a color picture have been developed. Devices displaying a picture in monochrome (single color) such as what we call monochrome display devices have been also in demand and been developed. For example, in a field of a front-door intercom, color picture displays using liquid crystal display devices are of use. However, monochrome display devices using a flat type cathode ray tube (flat CRT) which costs relatively low are also often in use since color liquid crystal display devices cost relatively high.

A flat CRT has a configuration in which electron guns and a fluorescent screen are provided on the same plane and electron beams are emitted obliquely on the fluorescent screen, unlike a straight-type CRT in which electron beams are emitted from the electron guns vertically to the center of the fluorescent screen. A straight-type CRT is capable of color picture display by discriminating three electron beams producing read (R), green (G) and blue (B) through a color selection mechanism and by emitting the electron beams on a fluorescent screen comprising three kinds of

phosphor emitting in red, blue and green. A flat CRT for displaying a monochrome picture displays a monochrome picture by, for example, forming the whole fluorescent screen by white emitting phosphor and scanning the fluorescent screen by a single electron beam. The flat CRT is often used for, for example, a picture display unit of a master apparatus of a front-door intercom and a monitor of a portable television set since the flat CRT can be formed thinner than the straight-type CRT.

In a flat CRT for monochrome display, there is also a case where color picture display is partially preferred. A front-door intercom with a various kinds of sensors such as a fire detector and a gas detector serves as a security system as a whole. In such a system, it is desirable, in the master apparatus, to notify the user by displaying the emergency in a different color (for example, red) from the regular color used for main picture display so that the users can be alerted. However, in a front-door intercom of the related art using a flat CRT for monochrome display, it is necessary to provide a separate device for color display in addition to the regular picture display using the flat CRT in order to display warning in case of emergency. An example of a device for color display used in a front-door intercom of the related art is one in which light of a lamp in a predetermined color (for example, white or red) is emitted from the reverse side onto a transparent substrate to which patterns such as letters or figures are color-printed so that the color-printed areas emit light.

In the display method mentioned above, warning effect is poor since, for example, warning is displayed simply by a red lamp or the like so that the

picture display is monotonic. In the related art, it is necessary to physically provide a display area separately from a main picture display area by providing a display device only for color display in addition to the flat CRT, which displays the main picture. This could be an obstacle to miniaturizing the device. There are still other problems. For example, in the case where a device for color display is composed of a lamp and a color-printed substrate, cost of providing electric wiring is required in addition to the lamp and the color-printed substrate. Furthermore, in the related art, design of the device becomes limited since it is necessary to separately provide the display area for warning.

In the front-door intercom and the like of the related art, if a specific figured picture indicating warning and the like is to be displayed by only using a CRT without separately providing a display device for warning only, it is necessary to provide a character signal generator for providing picture to be displayed. In such a device structure, portion with black-level signals is formed by blanking picture signals inputted in a normal state. Then, the picture signals generated by the character signal generator are superimposed on the portion with black-level signals or the picture signals generated by the character signal generator are directly superimposed on the picture signals inputted in a normal state. Thereby, a picture indicating warning and the like is displayed. However, in such a device structure, it is necessary to provide a character signal generator for making a specific picture, which is costly. Also, if a method of picture display by such structure is applied to a flat CRT for monochrome display, all of the picture

can be only displayed in monochrome. Therefore, even if the method is used for picture display for warning, the warning effect is poor.

SUMMARY OF THE INVENTION

The invention has been designed to overcome the foregoing problems. An object of the invention is to provide a CRT and a method of picture display, which can easily perform picture display in the colors different from that of the main picture display.

A CRT of the invention displays a main picture in a single color and comprises: an electron gun for emitting electron beams; a first picture display unit including a phosphor which emits a single color upon incidence of electron beams while displaying a main picture by emission of the single color emission phosphor; and a second picture display unit including another phosphor which emits another color different from the single color emission phosphor upon incidence of the electron beams in a region different from the region where the single color emission phosphor is provided for displaying another picture in a color different from that of display of the main picture by emission of the another phosphor.

A method of displaying a picture of the invention is a method in which a CRT displays a main picture in a single color, wherein; a phosphor emitting a single color upon incidence of electron beams is provided and a main picture is displayed in a single color by emission of the single color emission phosphor; and another phosphor emitting a color different from the single color emission phosphor upon incidence of electron beams is provided

in a region different from the region where the single color emission phosphor is provided, and another picture is displayed in another color different from the main picture by emission of the another phosphor.

In a CRT and a method of displaying a picture of the invention, a main picture is displayed in a single color by emission of the single color emission phosphor; and another picture is displayed in another color different from the main picture by emission of another phosphor provided in a region different from the region where the single color emission phosphor is provided.

In the invention, the single color emission phosphor is, for example, a white emission phosphor which emits in white. The white emission phosphor includes, in addition to a phosphor emitting white by itself, a phosphor composed of, for example, a blue emission phosphor and a yellow emission phosphor mixed in an appropriate proportion so as to look like a white emission phosphor. Also, in the invention, a single color does not only mean a single wavelength region of light but includes the case where a plurality of wavelength regions of light are mixed and recognized as a single color by eyes of human beings.

Other and further objects, features and advantages of the invention will appear more fully from the following description.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a structural figure showing a draft of a front-door intercom of the invention and its peripheral apparatuses.

Fig. 2 is a cross section showing the main structure of the main body of the master apparatus of a front-door intercom of the invention.

Fig. 3 is a block diagram showing a draft of the circuit in relation to picture display in the master apparatus of a front-door intercom of the invention and the picture display area.

Fig. 4A to Fig. 4D are figures for describing examples of the shapes of icons formed in a second phosphor layer of a flat CRT.

Fig. 5 is a figure for describing an example in which icon display area is provided under a main picture display area.

Fig. 6 is a figure for describing an example in which icon display area is provided above the main picture display area.

Fig. 7 is a figure for describing an example in which icon display area is provided in the right-hand side of the main picture display area.

Fig. 8 is a figure for describing an example in which icon display area is provided in the left-hand side of the main picture display area.

Fig. 9 is a figure for describing an example in which icon display area is provided above and in the right-hand side of the main picture display area.

Fig. 10 is a figure for describing an example in which icon display area is provided above and in the left-hand side of the main picture display area.

Fig. 11 is a figure for describing an example in which icon display area is provided under and in the right-hand side of the main picture display area.

Fig. 12 is a figure for describing an example in which an icon display area is provided under and in the left-hand side of the main picture display

area.

Fig. 13 is a figure for describing an example in which an icon display area is provided in the whole area around the main picture display.

Fig. 14 is a figure for describing an example in which two lines of icon display areas are provided under the main picture display area.

Fig. 15 is a figure for describing a form example of the whole display area in the case where the aspect ratio of the main picture display area of the picture display unit is 4 : 3.

Fig. 16 is a figure for describing another form example of the whole display area in the case where the aspect ratio of the main picture display area of the picture display unit is 4 : 3.

Fig. 17 is a figure for describing a form example of the whole display area in the case where the aspect ratio of the whole display area of the picture display unit is 4 : 3.

Fig. 18 is a figure for describing another form example of the main display area in the case where the aspect ratio of the whole display area of the picture display unit is 4 : 3.

Fig. 19 is a figure for describing still another form example of the main display area in the case where the aspect ratio of the whole display area of the picture display unit is 4 : 3.

Fig. 20 is a figure for describing an example of picture display in the case where icons are displayed by controlling intensity level of picture signals.

Fig. 21 is a figure for describing another example of picture display in a

flat CRT.

Fig. 22 is a figure for describing still another example of picture display in a flat CRT.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Preferred embodiments of the invention will now be described in detail in the followings with reference to the drawings.

A front-door intercom 1 shown in Fig. 1 is connected to peripheral apparatuses 20 for security surveillance composing a security system as a whole. The front-door intercom 1 comprises a subsidiary apparatus 2 provided at, for example, the front-door and a master apparatus 3 provided, for example, inside which is capable of performing audio and visual communication between the subsidiary apparatus 2.

The peripheral apparatuses 20 comprise, for example, a fire detector 20a having a thermal sensor for detecting fire, a gas detector 20b having a gas sensor for detecting gas leakage, an electric key 20c capable of managing locking and unlocking electrically provided at, for example, front door, and a call-button 20d having a push-button switch for detecting the operation state of buttons. The call-button 20d is provided for, for example, elderly people provided at, for example, rest rooms or bathrooms used for notifying the case of emergency. The peripheral apparatuses 20 are not limited to the ones shown in Fig. 1 but other apparatuses may be used.

In the peripheral apparatuses 20, the fire detector 20a outputs fire detection signals S1a to the master apparatus 3 of the front-door intercom 1

for notifying the emergency when detecting fire. The gas detector 20b outputs gas detection signals S1b to the master apparatus 3 for notifying gas leakage when detecting gas leakage. The electric key 20c outputs detection signals S1c to the master apparatus 3 for notifying changes in the locking state. The call-button 20d outputs detection signals S1d to the master apparatus 3 when the button operation is performed. In the followings, each of the signals outputted from a plurality of the peripheral apparatuses 20 are collectively referred to as surveillance signals S1.

In the front-door intercom 1, the subsidiary apparatus 2 picks up the image of visitors outside while comprising a camera 13 having a function of transmitting the picked-up image to the master apparatus 3 and a communicator 14 composed of a speaker and a microphone having a function of audio communication between the master apparatus 3. The subsidiary apparatus 2 generates frequency modulation signals by modulating the frequency of, for example, each of image signals obtained by the camera 13 and audio signals obtained by the communicator 14, and transmit the frequency modulation signals frequency multiplex to the master apparatus 3. The subsidiary apparatus 2 receives frequency-modulated audio signals from the master apparatus 3, using, for example a frequency band different from the one used for transmission to the master apparatus 3 and outputs the audio signals from the communicator 14.

In the front-door intercom 1, the master apparatus 3 comprises a cuboid main body 3a. The master apparatus 3 comprises a picture display unit 11 located in, for example, the front face of the main body 3a and the

communicator 14 located in, for example, the side area of the main body 3a. The communicator 14 includes a speaker and a microphone having a function of audio communication between the subsidiary apparatus 2. The picture display unit 11 displays a picture formed by a flat type cathode ray tube (flat CRT) 30 (Fig. 2), which will be described later, and has a function of mainly displaying the image picked up by the camera 13 of the subsidiary apparatus 2.

Y direction shown in Fig. 2 corresponds to the upward direction of the screen of the picture display unit 11. As shown in Fig. 2, the main body 3a comprises a casing 15 forming a cuboid appearance. A flat CRT 30 is incorporated inside the casing 15. In Fig. 2, a reflection-mode CRT is shown as an example of a flat CRT. The flat CRT 30 comprises a screen panel 31, a front panel (display panel) 32 and a funnel 33. The screen panel 31, the front panel 32 and the funnel 33 are formed of a transparent glass member and the flat glass tubes are composed of the three-bodied structure with the three panels. A neck 33a having a thin-long shape to which electron gun 35 are provided is formed in the back end of the funnel 33. In the funnel 33, deflection yoke 36 is provided in the peripheral portion of the neck 33a for performing deflection control on electron beams EB emitted from the electron guns 35. In the casing 15, a protection member 16 for protecting the front panel 32 is provided in the portion corresponding to front panel 32 of the flat CRT 30. The protection member 16 is formed of, for example a transparent resin.

The electron guns 35, although the detail is not shown in the figure,

have a configuration in which a plurality of grids are arranged in the front portion of a thermionic cathode body comprising a cathode (thermionic cathode), so as to perform controlling, acceleration and the like of the electron beams EB emitted from the cathode are performed in each grid. The electron beams EB emitted from the electron guns 35 are deflection-controlled by the deflection yokes 36 and are emitted onto a phosphor layer 34 formed on the screen panel 31.

The front panel 32 is plane. The screen panel 31 is curved in the vertical direction (upward and downward direction). A conductive reflection film is formed by evaporating, for example, aluminum (Al) in the inner wall of the screen panel 31, that is, in the surface facing the front panel 32. The phosphor layer 34 is also formed in the inner wall of the screen panel 31 with the reflection film in between. The reflection film formed in the screen panel 31 has a function of reflecting luminous light generated by the incidence of the electron beams EB to the phosphor layer 34 to the front panel 32. In the flat CRT 30, the optical picture formed by the light reflected by the reflection film can be observed from the front panel 32.

The phosphor layer 34 formed on the screen panel 31 is formed of phosphor which emits according to incidence of the electron beams EB. In general, the ordinal monochrome-display flat CRT, the whole phosphor layer 34 is formed of a white emission phosphor. However, in the flat CRT 30 according to the embodiment, a second phosphor layer 34b formed of another phosphor which emits different colors from that of the white emission phosphor is provided in addition to a first phosphor layer 34a formed of the

white emission phosphor. The flat CRT 30 according to the embodiment is notably different from a flat CRT of the related art in its configuration in which, specifically, the second phosphor layer 34b is provided.

The first phosphor layer 34a is mainly for performing monochrome display of the image picked up by the camera 13 of the subsidiary apparatus 2 (Fig. 1). In other words, in the embodiment, an image 41 picked up by the camera 13 is monochrome-displayed in a main picture display area 11a by an emission ray R1 generated by scanning the first phosphor layer 34a by the electron beams EB as shown in Fig. 2 and Fig. 3. In the followings, as described above, the images mainly taken by the camera 13 of the subsidiary apparatus 2 and displayed in the main picture display area 11a is also called a 'main picture'. The picture displayed in the main picture display area 11a is not limited to the images picked up by the camera 13 of the subsidiary apparatus 2 but other images may be displayed as the main picture. The main picture display area 11a including the first phosphor layer 34a corresponds to a specific example of a 'first picture display unit' of the invention.

On the other hand, the second phosphor layer 34b is provided in order to display other pictures different from the main picture displayed in the main picture display area 11a. In other words, in the embodiment, another image 42 different from the main picture is displayed in a color different from the main picture in an icon display area 11b by an emission ray R2 generated by scanning the second phosphor layer 34b by the electron beams EB as shown in Fig. 2 and Fig. 3. In the front-door intercom 1

according to the embodiment, what we call icons are displayed in the icon display area 11b as pictures different from the main picture as shown in Fig. 3 and Fig. 4. In the followings, the image 42 displayed in the icon display area 11b is also called an icon.

The second phosphor layer 34b is formed in the shape of the icon 42, which is to be displayed. Therefore, the light is emitted in the shape of the second phosphor layer 34b, that is, the shape of the icon 42 when the region where the second phosphor layer 34b is provided is scanned by the electron beams EB. In other words, the icon 42 displayed in the icon display area 11b is almost in the same shape as the formation pattern of the second phosphor layer 34b which has been formed in a predetermined shape. The first phosphor layer 34a is uniformly provided in the region corresponding to the main picture display area 11a. However, it is not necessary to provide the second phosphor layer 34b in the whole region corresponding to the icon display area 11b. Basically, the second phosphor layer 34b is partially provided only in the region where the icon 42 is to be displayed. In this case, the region where the icon 42 is not displayed (the region where the second phosphor layer 34b is not provided) may have a configuration of a so-called black matrix in which, for example, black substances (graphite and the like) are laminated. The icon display area 11b including the second phosphor layer 34b corresponds to a specific example of a 'second picture display unit' of the invention.

In Fig. 4, the slashed region represents the phosphor. In the embodiment, examples of the icon 42 displayed in the icon display area 11b

are symbols, characters and various kinds of figures (circles, quadrangles or any shapes). The second phosphor layer 34b is formed in the shapes of these various kinds of icons.

For example, Fig. 4A is an example of the second phosphor layer 34b formed in the shape of a symbol. Fig. 4B is an example of the second phosphor layer 34b formed in the shape of the character 'M'. Fig. 4C is an example in which the peripheral of a region 42b where the phosphor is not provided is surrounded by a phosphor layer 42a to be in the shape of a symbol so that the second phosphor layer 34b is formed in the shape of a symbol as a whole. Fig. 4D is an example in which the second phosphor layer 34b is formed of the phosphors in two colors. In Fig. 4D, the peripheral of the phosphor layer 42c formed in the shape of a symbol is surrounded by the phosphor layer 42a formed of the phosphor in a color different from the phosphor layer 42c. As described, the second phosphor layer 34b may be formed of phosphors in a plurality of colors. In the flat CRT 30 according to the embodiment, the icon 42 in almost the same shape as the formation pattern of the second phosphor layer 34b is displayed in the icon display area 11b by the electron beams EB scanning the second phosphor layer 34b formed as described. In the flat CRT 30 according to the embodiment, the phosphor layer itself is formed in the shape of the icon 42. Therefore, icons in the complicated shapes can be displayed with high precision compared to the case where the shapes of the icon 42 are formed by scanning by the electron beams themselves.

More specific example of the icon 42 displayed in the icon display

area 11b as another picture is, for example, an icon for warning in case of emergency. Icons for warning are, for example, ones that correspond to kinds of the surveillance signals S1 from the peripheral apparatuses 20 (Fig. 1). For example, if the surveillance signals S1 are signals from the fire detector 20a for notifying fire, it is preferable to perform icon display so that the occurrence of fire can be easily notified to the users. That is, the icon 42 displayed in the icon display area 11b may better be in the shape of fire, for example, like the icon 42－1 as shown in Fig. 3. For example, if the surveillance signals S1 are signals from the electric key 20c notifying the change in the locking state, the icon 42 displayed in the icon display area 11b may better be in the shape of a key, for example, like the icon 42－2 as shown in Fig. 3. Furthermore, not only the shapes of icons but also the colors of icons are preferable to be good for warning. The case of icon 42－1 indicating the occurrence of fire may be displayed in a color representing fire (for example, red). Coloring the icon 42 can be easily achieved by forming the second phosphor layer 34b using the phosphor which emits the desired color.

A method of manufacturing the first phosphor layer 34a and the second phosphor layer 34b will now be briefly described. The first phosphor layer 34a and the second phosphor layer 34b can be formed by laminating the phosphor substance in the inner wall of the screen panel 31 by printing such as thermal transfer printing or by electrodeposition. The first phosphor layer 34a and the second phosphor layer 34b may be formed simultaneously by, for example, printing or may be formed through the

separate steps. After forming the first phosphor layer 34a by electrodepositing, the second phosphor layer 34b may be formed separately by printing. Specifically, the second phosphor layer 34b is easily formed using a method in which the portion with printed icons in the printed film to which arbitrary icon shapes are printed is transcribed to the inner wall of the screen panel by the thermal transfer printing. By applying this method, it becomes possible to form arbitrary shapes of icons in the second phosphor layer 34b easily at low cost as a special order at a request of the users of the front-door intercom 1.

In Fig. 2 and Fig. 3, an example is shown in which the second phosphor layer 34b is provided in the lower side of the screen than the side of the first phosphor layer 34a, and the main picture display area 11a is located in the lower side than the icon display area 11b. However, the positioning of the first phosphor layer 34a and the second phosphor layer 34b, and the positioning of the main picture display area 11a and the icon display area 11b are not limited to these.

Fig. 5 to Fig. 14 show a plurality of specific examples of the position where the icon display area 11b is to be provided. In the screen panel 31 (Fig. 2) of the flat CRT 30, the second phosphor layer 34b can be provided in, for example, at least one of the region above, below, the left-hand side or the right-hand side of the region where the first phosphor layer 34a is provided.

Fig. 5 to Fig. 8 are examples in which the second phosphor layer 34b is provided only in one of the regions above, below, the left-hand side or the right-hand side of the region where the first phosphor layer 34a is provided.

Fig. 5 shows an example in which, like the example shown in Fig. 2 and Fig. 3, the second phosphor layer 34b is provided below the first phosphor layer 34a and the icon display area 11b is formed below the main picture display area 11a in the picture display unit 11 of the master apparatus 3. Fig. 6 shows an example in which the second phosphor layer 34b is provided above the first phosphor layer 34a and the icon display area 11b is formed above the main picture display area 11a. Fig. 7 shows an example in which the second phosphor layer 34b is provided on the right-hand side of the first phosphor layer 34a and the icon display area 11b is formed on the right-hand side of the main picture display area 11a. Fig. 8 shows an example in which the second phosphor layer 34b is provided on the left-hand side of the first phosphor layer 34a and the icon display area 11b is formed on the left-hand side of the main picture display area 11a.

Fig. 9 to Fig. 12 show examples in which the second phosphor layer 34b is provided in two regions above, below, the left-hand side or the right-hand side of the region where the first phosphor layer 34a is provided. For example, Fig. 9 is an example in which the second phosphor layer 34b is formed above and in the right-hand side of the first phosphor layer 34a and the icon display area 11b is provided above and in the right-hand side of the main picture display area 11a. Fig. 10 shows an example in which the second phosphor layer 34b is provided above and in the left-hand side of the first phosphor layer 34a and the icon display area 11b is formed above and in the left-hand side of the main picture display area 11a. Fig. 11 shows an example in which the second phosphor layer 34b is formed below and in the

right-hand side of the first phosphor layer 34a and the icon display area 11b is provided below and in the right-hand side of the main picture display area 11a. Fig. 12 shows an example in which the second phosphor layer 34b is formed below and in the left-hand side of the first phosphor layer 34a and the icon display area 11b is provided below and in the left-hand side of the main picture display area 11a.

Fig. 13 shows an example in which the second phosphor layer 34b is provided in the whole regions above, below, in the right-hand side and the left-hand side of the first phosphor layer 34a surrounding the region wherein the first phosphor layer 34a is provided, and the icon display area 11b is formed in the whole regions above, below, in the right-hand side and the left-hand side of the main picture display area 11a. Fig. 14 shows an example in which two lines of the second phosphor layer 34b are provided below the first phosphor layer 34a and two lines of the icon display area 11b are formed below the main picture display area 11a.

Positioning of the first phosphor layer 34a and the second phosphor layer 34b, and positioning of the main picture display area 11a and the icon display area 11b are not limited to the examples shown in Fig. 5 to Fig. 14 but other positioning may be applicable. For example, in Fig. 5 to Fig. 13, examples in which only one line of icon display area 11b is provided above, below, in the right-hand side or the left-hand side of the main picture display area 11a. However, two or more lines of the icon display area 11b may be provided in all the examples.

Next, the aspect ratio of the main picture display area 11a and the

icon display area 11b will be described by mainly referring to Fig. 15 to Fig. 19.

First, the case where the ratio of the lateral length X1 and the longitudinal length Y1 of the main picture display area 11a is 4 : 3 as in the ordinary picture display device is described. In the case where the icon display area 11b is formed below or above the main picture display area 11a as in the examples shown in Fig. 5 and Fig. 6, if the aspect ratio of the main picture display area 11a is 4 : 3, it is necessary to provide a display area close to the aspect ratio of, for example, 1 : 1 (square shape) in the total area of the main picture display area 11a and the icon display area 11b. In this case, as shown in Fig. 15, the lateral length of the total display area of the main picture display area 11a and the icon display area 11b is equal to the lateral length X1 of the main picture display area 11a. However, the longitudinal length Y2 is longer than the longitudinal length Y1 of the main picture display area 11a.

As in the examples shown in Fig. 7 and Fig. 8, in the case where the icon display area 11b is formed on the right-hand side or the left-hand side of the main picture display area 11a, if the aspect ratio of the main picture display area 11a is 4 : 3, it is necessary to provide a wide display area close to the aspect ratio of, for example, 16 : 9 in the total area of the main picture display area 11a and the icon display area 11b. In this case, as shown in Fig. 16, the longitudinal length of the total display area of the main picture display area 11a and the icon display area 11b is equal to the longitudinal length Y1 of the main picture display area 11a. However, the lateral length

X2 is longer than the lateral length X1 of the main picture display area 11a.

The case where the ratio of the lateral length X2 and the longitudinal length Y2 of the total display area of the main picture display area 11a and the icon display area 11b is 4 : 3 as the ordinary picture display device. For example, as the examples shown in Fig. 5 and Fig. 6, in the case where the icon display area 11b is formed below or above the main picture display area 11a, if the aspect ratio of the total display area is 4 : 3, the main picture display area 11a becomes, for example, wide. In this case, as shown in Fig. 17, the lateral length X1 of the main picture display area 11a is almost equal to the lateral length X2 of the total display area. However, the longitudinal length Y1 becomes shorter than the longitudinal length Y2 of the total display area.

As the examples shown in Fig. 7 and Fig. 8, in the case where the icon display area 11b is formed on the right-hand side or the left-hand side of the main picture display area 11a, if the aspect ratio of the total picture display area is 4 : 3, the main picture display area 11a becomes a display area close to the aspect ratio of, for example, 1 : 1 (square shape). In this case, the longitudinal length Y1 of the main picture display area 11a is almost equal to the longitudinal length Y2 of the total display area. However, the lateral length X1 becomes shorter than the lateral length X2 of the total display area.

As the examples shown in Fig. 9 to Fig. 12, in the case where the icon display area 11b is formed in two regions among four regions of above, below, the left-hand side and the right-hand side wherein the main picture display

area 11a is provided, if the aspect ratio of the total display area is 4 : 3, the aspect ratio of the main picture display area 11a is, for example, 4 : 3. In this case, as shown in Fig. 19, the longitudinal length Y1 and the lateral length X1 of the main picture display area 11a become shorter than the longitudinal length Y2 and the lateral length X2 of the total display area.

The correlation between the aspect ratio of the main picture display area 11a and the aspect ratio of the total display area is not limited to the ones mentioned above, but the aspect ratio of each display area can be set at any value.

Fig. 3 shows a front view of the flat CRT 30 taken from the front panel 31 side. As shown in Fig. 3, the master apparatus 3 comprises, as a control circuit of the flat CRT 30, an image signal input processing 52 which image signals Vin taken by, for example, the camera 13 of the subsidiary apparatus 2 (Fig. 1) are inputted to and performs amplifying or the like of the inputted image signals Vin, a deflection circuit 53 which separates horizontal synchronizing signals and vertical synchronizing signals included in image signals Ss outputted from the image signal input processing 52 and controls the deflection yoke 36 based on the horizontal synchronizing signals and the vertical synchronizing signals obtained, and a video circuit 54 which, based on luminance signals included in image signals Sv outputted from the image signal input processing 52, drives the electron guns 35 and controls the amount of electron beams EB emitted from the electron guns 35. The master apparatus 3 also comprises a control unit 51 to which surveillance signals S1 from the peripheral apparatuses 20 (Fig. 1) are inputted and

controls the image signal input processing 52, the deflection circuit 53 and the video circuit 54 based on the inputted surveillance signals S1. The master apparatus 3 further comprises an audio circuit for, for example, performing audio communication between the subsidiary apparatus 2 in addition to the circuits shown in the figure. However, since the distinctive feature of the master apparatus 3 according to the embodiment is mainly about picture display, the description in detail will be omitted.

The control unit 51, when the surveillance signals S1 from the peripheral apparatuses 20 (Fig. 1) are inputted, controls the image signal input processing 52, the deflection circuit 53 and the video circuit 54 so that the icon 42 in accordance with the kinds of the surveillance signals S1 is displayed in the icon display area 11b. For example, the control unit 51 controls displaying icon such as the icon 42−1,which notifies the occurrence of fire, if the surveillance signals S1 are signals S1a notifying fire from the fire detector 20a (Fig. 1). A specific example of a control method for displaying the icon 42 in the icon display area 11b will be described in detail in the followings with reference to the figure.

Next, operation of the front-door intercom 1 having a configuration as described will be described.

The total operation of the front-door intercom 1 will be described. In the front-door intercom 1, the subsidiary apparatus 2 picks up the images of visitors outside by the camera 13 and transmits the picked up image to the master apparatus 3. Also, the subsidiary apparatus 2 obtains the voices of visitors by the microphone of the communicator 14 and transmits the

obtained voice to the master apparatus 3. The subsidiary apparatus 2 obtains audio signals from the master apparatus 3 and the voice based on the obtained audio signals are outputted from the speaker of the communicator 14. A method of transmitting voice and image from the subsidiary apparatus 2 to the master apparatus 3 is, for example, a method in which frequency modulation signals are generated by frequency-modulating the image signals obtained by the camera 13 and the audio signals obtained in the communicator 14, respectively, and then transmitting the frequency modulation signals after frequency-multiplying.

The master apparatus 3 outputs voice from a handset 12 based on the audio signals obtained from the subsidiary apparatus 2 and outputs the voice of the user of the master apparatus 3 to the subsidiary apparatus 2. Also, the master apparatus 3 monochrome-displays a picture based on the image signals obtained from the subsidiary apparatus 2 as a main picture 41 in the main picture display area 11a of the picture display unit 11. Furthermore, the master apparatus 3 always supervise the surveillance signals S1 from the peripheral apparatuses 20 and, if necessary, displays the icon 42 in accordance with the kinds of the surveillance signal S1 in the icon display area 11b of the picture display unit 11. For example, the master apparatus 3 displays an icon in the shape of the icon 42−1 as shown in Fig. 3, if the surveillance signals S1 are signals S1a notifying fire from the fire detector 20a (Fig. 1). Also, the master apparatus 3 displays an icon with the shape of icon 42−2 as shown in Fig. 3, if the surveillance signals S1 are signals S1d notifying changes in the locking state from the electric key 20c.

Next, a specific example of a control method for displaying the icon 42 in the icon display area 11b will be described by mainly referring to Fig. 20 to Fig. 22.

In the flat CRT 30 according to the embodiment, as described, a phosphor layer in the shape of the icons to be displayed is readily formed in the second phosphor layer 34b. Therefore, control for displaying the icon may be performed in a manner that the electron beams EB are emitted thoroughly and uniformly on the region of the second phosphor layer 34b corresponding to the icon to be displayed. This control may be performed by, for example, a method in which intensity level of the image signals is controlled or a method in which deflection direction of the electron beams EB is controlled together with intensity level of the image signals.

In a method of controlling the intensity level of image signals, the control unit 51 (Fig. 3) controls the image signal input processing 52 and the video circuit 54 so that the intensity level of the portion of the inputted image signals corresponding to the icon display area 11b becomes black level by applying the blanking signals and the intensity level of the portion corresponding to the icon 42 to be displayed becomes white level by superimposing image signals for icon display onto the image signals to which the blanking signals have been applied. The blanking signals and the image signals for icon display are formed by, for example, the control unit 51 and are outputted to the image signal input processing 52 and the video circuit 54. The image signal input processing 52 and the video circuit 54 output the inputted image signals Vin after applying the blanking signals

and the image signals for icon display from the control unit 51.

In a display example shown in Fig. 20, by applying the blanking signals to the image signals of the portion corresponding to the icon display area 11b in one vertical scanning period (1V), the lower region of the main picture 41 displayed in the main picture display area 11a becomes blank. The blank region becomes the icon display area 11b. In the display example, the aspect ratio of the total display area including the main picture display area 11a and the icon display area 11b is set to be almost 4 : 3.

Fig. 21 shows an example in which the main picture 41 which has been compressed is displayed in the main picture display area 11a and the icon 42 are displayed by superimposing image signals for icon display to the remained portion of vertical scanning period obtained by compressing. There is a method of displaying the main picture 41 after compressing in which, in the main picture display unit 11a, the magnitude of the vertical saw tooth for performing vertical deflection applied to the deflection yoke is made smaller than usual. The main picture 41 may also be displayed after being compressed by being partially thinned out (thinning out the scanning line). In the display example, the aspect ratio of the total display area including the main picture display area 11a and the icon display area 11b is also set to be almost 4 : 3.

In a display example shown in Fig. 22, the aspect ratio of the total display area including the main picture display area 11a and the icon display area 11b is set to be almost 1 : 1. Such display can be achieved by, for example, taking the scanning period longer than usual by shortening the

blanking interval of the saw tooth for performing the vertical deflection and scanning the icon display area 11b in the extended scanning period.

Control methods of displaying the icon 42 are not limited to the ones mentioned above but other methods may be used.

As described, in the embodiment, the main picture is monochrome-displayed in the main picture display area 11a by emission in the first phosphor layer 34a formed of white emission phosphor while providing the second phosphor layer 34b formed of a different phosphor in a region different from the first phosphor layer 34a in order to perform icon display as another picture in a color different from the main picture by emission of the second phosphor layer 34b. Therefore, picture display in another color different from the display of the main picture can be easily performed.

According to the embodiment, color display of icon is possible. Therefore, warning effect in the case of using the front-door intercom 1 as a security system can be improved. In the related art, icon warning symbols can be displayed on the screen by superimposing method (a composing method of screens in which one screen is formed by superimposing two or more screens). The superimposing can be achieved by installing special software on a signal processing system. However, in a case of apparatuses that perform monochrome display, warning effect for drawing attention cannot be expected since color display of the warning symbols cannot be performed. According to the embodiment, this problem can be solved. Furthermore, according to the embodiment, color display can be performed using the driving circuit of the CRT for monochrome display as the drive for

the flat CRT 30. Therefore, color display can be achieved easily at low cost. Also, in the embodiment, the shapes of the icons are directly formed in the fluorescent screen so that even icons with complicated shapes can be displayed with high precision.

In the embodiment, it is not necessary to provide another display device using a lamp or the like in addition to a picture display device for displaying a picture from the subsidiary apparatus 2 like in the related art. Therefore, color display can be achieved at low cost and without enlarging the size of the master apparatus 3. For example, in the embodiment, it is not necessary to provide a lamp for performing color display and to separately provide a lamp display area for performing color display so that the device can be minimized. Also, in the embodiment, it is not necessary to separately provided a display area for a lamp or the like so that desirable designs of the device can be achieved.

The invention is not limited to the above-mentioned embodiment but various kinds of modifications are possible. For example, in addition to a front-door intercom, the invention can be broadly applied to devices comprising a display unit which performs monochrome display of the main picture. For example, the invention can be applied to various kinds of monitor apparatuses such as portable television monitors or the like. Also, the invention is not limited to be used in picture display for security surveillance but can be applied to other usages. For example, the invention can be applied to the case where preferred pictures of the user are displayed always or at request.

Furthermore, in the invention, a case of a reflection-mode flat CRT is described. However, the invention can be applied to a transmission-mode flat CRT. In the transmission-mode flat CRT, picture is displayed from a screen panel side in which the phosphor layer 34 is provided, which is from the opposite side of the reflection-mode flat CRT 30, with the screen panel in between. If the transmission-mode flat CRT is used, in the configuration of the flat CRT shown in Fig. 2, a transparent conductive film (for example, a conductive film made of ITO : indium-tin oxide film) is provided in the inner wall of the screen panel 31 instead of a reflection film (not shown in the figure), and the phosphor layer 34 is formed on the transparent conductive film. Also, in the case of the transmission-mode flat CRT, a picture is observed from the opposite side (screen panel side) of the front panel 32. Therefore, a back panel is provided instead of the front panel 32. A conductive film is applied on almost the whole surface of the inner wall of the back panel facing the fluorescent screen and anode voltage is applied to the conductive film. Other basic configurations, operation and effects are identical to those of the reflection-mode flat CRT.

Moreover, the invention, in addition to the flat CRT, can be also applied to so-called a straight cathode ray rube in which electron beams from electron guns are vertically emitted to the center of the fluorescent screen. Also, in the above-mentioned embodiment, the first phosphor layer 34a is formed of a white emission phosphor and the main picture is monochrome-displayed. However, the first phosphor layer 34a may be formed of a single-color emission phosphor other than white and the main picture may

be monochrome-displayed in other color than black and white.

Also, in the embodiment, the icon 42 are easily displayed in the icon display area 11b by readily forming the second phosphor layer 34b in the perfectly same shape of icons to be displayed. However, the second phosphor layer 34b may be formed without being in the shape of icons. In other words, icon display may be performed by uniformly forming a phosphor which emits colors different from the white emission phosphor forming the first phosphor layer 34a in the region where the icon 42 to be displayed, and by scanning the uniformly-formed phosphor layer by electron beams in the shape of the icons to be displayed. In this case, the picture of the icon representing warnings and the like is displayed by, for example, providing a character signal generator for forming the picture of the icon, and superimposing image signals formed by the character signal generator onto the image signals inputted in a normal state. In this method, although it is necessary to provide a character signal generator for forming the picture of the icon, icon display can be performed in a color different from the picture in the main picture display area 11a.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within scope of the appended claims the invention may be practiced otherwise than as specifically described.